Ratios and Proportions
7-1

Which team has the best record?

Team	Wins	Losses	Ratio
Purple Power	10	5	2:1
Green Machine	19	10	1.9 : 1
Yellow Jackets	9	3	3:1
Blue Valkyries	28	14	2:1

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Using ratios to represent parts of the whole

Let's say you have six classes each day and they represent the sum total of time you spend at school. If you spend 9 hours at school, how long is each class?

6 classes : 420 minutes *or* 420 minutes : 6 classes?

If we want minutes/class then we want to divide 420 minutes by 6 classes: 420:6 or 420/6 = 70 minutes per class.

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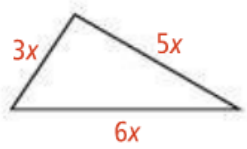
The lengths of the sides of a triangle are in the extended ratio 3 : 5 : 6. The perimeter of the triangle is 98 in. What is the length of the longest side?

Sketch the triangle. Use the extended ratio to label the sides with expressions for their lengths.



$3x + 5x + 6x = 98$	The perimeter is 98 in.
$14x = 98$	Simplify.
$x = 7$	Divide each side by 14.

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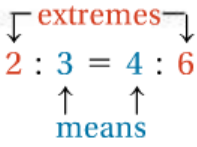
We talked about proportions being two ratios set equal to each other. Each *place* in the proportion has a label.

An equation that states that two ratios are equal is called a **proportion.** The first and last numbers in a proportion are the **extremes.** The middle two numbers are the **means.**



Note that for the proportion to be true, the extremes have to equal the means: $\frac{a}{b} = \frac{c}{d}$ thus ad = bc.

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Properties of Proportions

a, b, c, and d do not equal zero.

Property

(1) $\frac{a}{b} = \frac{c}{d}$ is equivalent to $\frac{b}{a} = \frac{d}{c}$.

(2) $\frac{a}{b} = \frac{c}{d}$ is equivalent to $\frac{a}{c} = \frac{b}{d}$.

(3) $\frac{a}{b} = \frac{c}{d}$ is equivalent to $\frac{a+b}{b} = \frac{c+d}{d}$.

How to Apply It

Write the reciprocal of each ratio.

$\frac{2}{3} = \frac{4}{6}$ becomes $\frac{3}{2} = \frac{6}{4}$.

Switch the means.

$\frac{2}{3} = \frac{4}{6}$ becomes $\frac{2}{4} = \frac{3}{6}$.

In each ratio, add the denominator to the numerator.

$\frac{2}{3} = \frac{4}{6}$ becomes $\frac{2+3}{3} = \frac{4+6}{6}$.

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For parts (a) and (b), use the proportion $\frac{x}{6} = \frac{y}{7}$. What ratio completes the equivalent proportion? Justify your answer.

a. $\frac{6}{x} = \frac{\blacksquare}{\blacksquare}$

b. $\frac{\blacksquare}{\blacksquare} = \frac{y+7}{7}$

c. Reasoning Explain why $\frac{6}{x-6} = \frac{7}{y-7}$ is an equivalent proportion to $\frac{x}{6} = \frac{y}{7}$.

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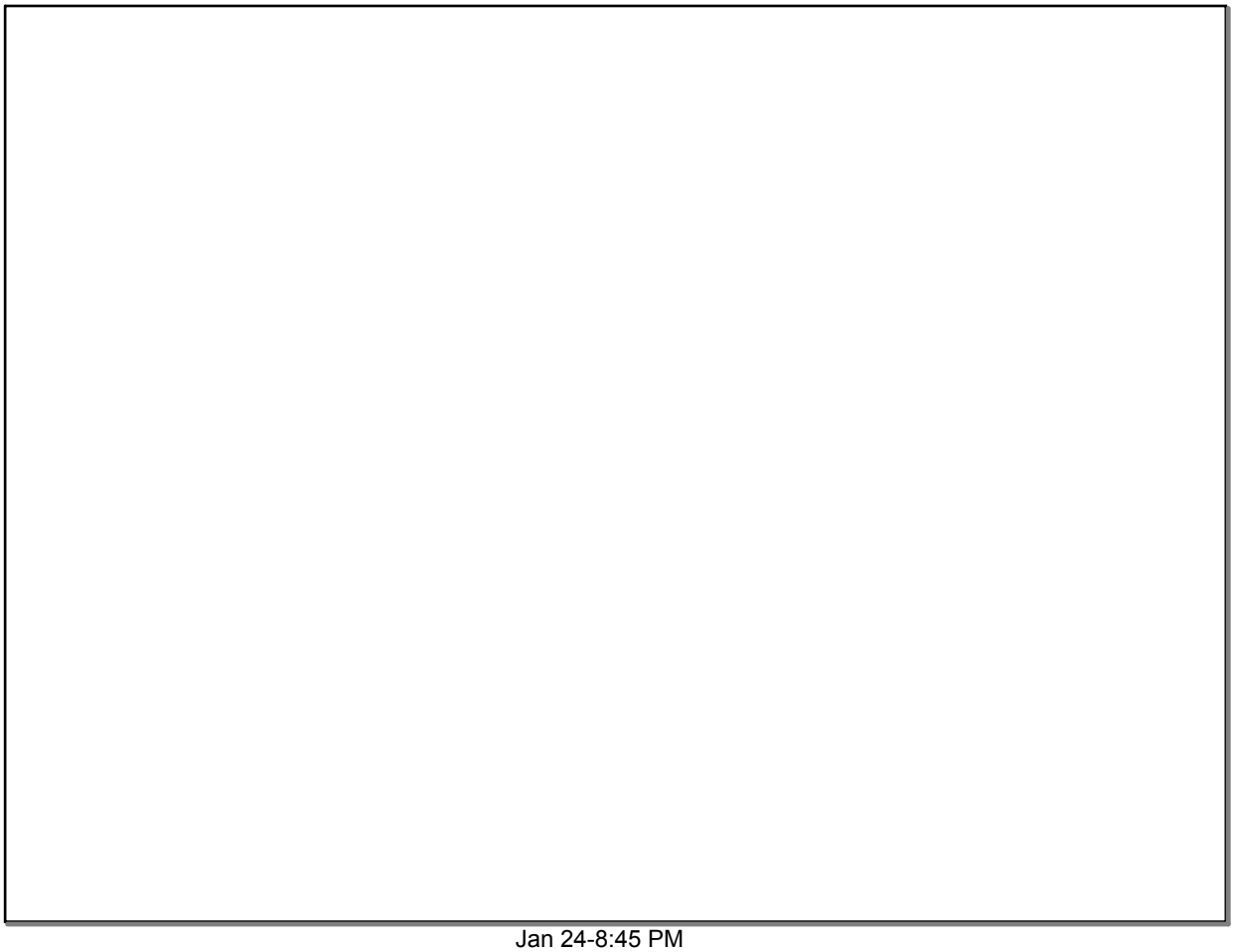

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